12) <u>Fewer frosts and droughts and less damage from them</u>

As water freezes, positively charged protons and negatively charged electrons separate. Frozen ice crystals become electrified as the top of the frost becomes warmer than the bottom of the frost. This causes charged ions to move from top to bottom (warm to cold), but it turns out that the positive ions can migrate faster. **The top of the frost ends up being negatively charged while the bottom is more positively charged, a concept known as charge separation. (23)**

In the paragraph: **2) <u>Reduction of solar radiation, especially ultraviolet rays and cosmic radiation</u>** we have described that some photoelectric sensitive materials such as metals, water, ice, and plants can also cause a photoelectric effect and release electrons, even though no short-wave ultraviolet radiation is applied. The electrons then combine with molecules in the air to form NAIs (Negative Air Ions) (17).

The negative ions in the air attract the positive ones and neutralize them before they fall to the ground, thus reducing the phenomenon of frost.

The positive ions that manage to settle are "attracted upwards by the negative ions", the frost particles breaking off their substrate and jumping toward the negative ions constantly, melting them. The scientific process is described below. (Photo 30) **(24)**

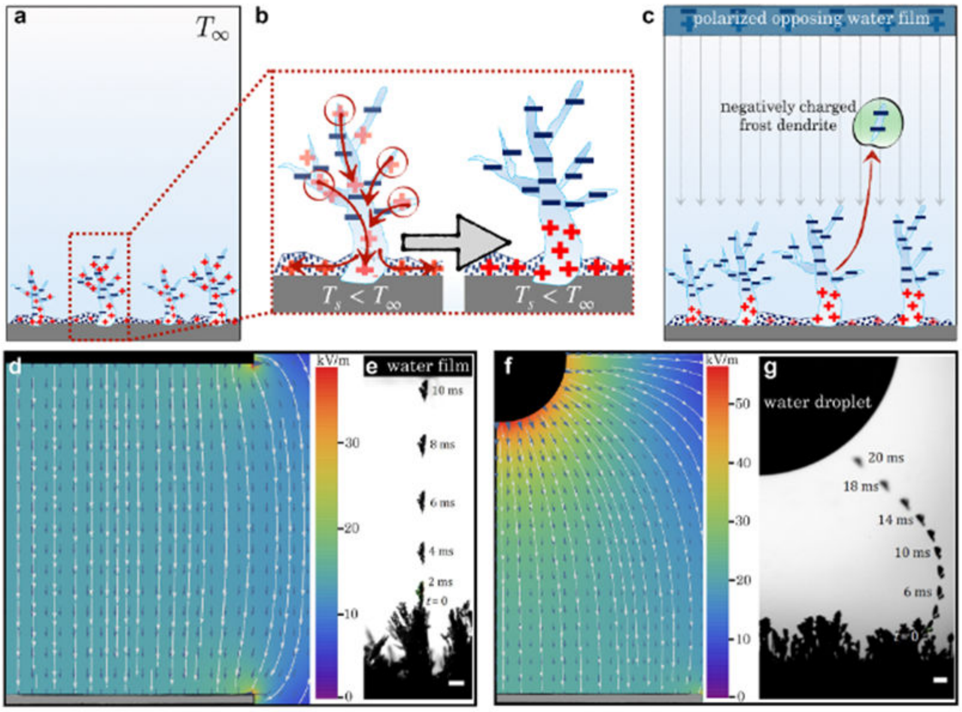

Figure 3. Origin of the attractive force on the frost dendrites. (a) Initial (nanoscale) frost exhibits a roughly uniform temperature and distribution of ions (defects) within the dendrites. (b) As the frost dendrites grow to a microscale, $T_\infty > T_s$, such that ions are more concentrated in the warmer upper dendrites. Positive ions then diffuse to the lower concentration basal frost at a much higher mobility than the negative ions. (c) This charge separation enables the fracture and jumping of frost in the presence of an opposing polarizable liquid. (d) Numerical simulation showing that, when the frost and opposing water film are both planar, the electric field is uniform. (e) This results in a straight trajectory and constant terminal velocity for jumping frost particles, validated here by chronophotography, where the particle consistently travels ~300 μm every 2 ms at terminal velocity to cross the 2.5 mm gap. (f) Numerical simulation showing that, when frost is now opposite a pendant droplet (*i.e.*, plate and sphere configuration), the electric field is nonuniform with curved field lines. (g) Chronophotography (successive position of the dendrite temporally separated by 2 ms) confirms a curved trajectory for a jumped dendrite opposite a water droplet, where the sudden increase in acceleration near the droplet is confirmed by increased distance between successive positions. Both scale bars represent 100 μm.

~Photo 30